Quarterly Status, Management, and Cost Report #11

Contract Name:	Seismic Calibration for IMS Stations in North Africa and Western Asia (Group 2)
Contractor:	Science Applications International Corporation, SAIC
Contract Number:	DTRA01-00-C-0013
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Period of Performance:	March 1, 2000 – February 28, 2003
Reporting Period:	September 14, 2002 – December 6, 2002

Background

The Group 2 Consortium is composed of SAIC as the prime contractor with Harvard University, University of Colorado at Boulder (CUB), University of California San Diego (UCSD), Geophysical Institute of Israel (GII), Multimax, and Western Services as subcontractors.

Travel-time corrections will be developed, tested, and validated in two phases over a period of three years. The team will construct location corrections, as recommended by CTBT/WGB/TL-2/18, using three methodologies: 1) Tectonic regionalization will be used to assign 1D velocity models to each tectonic province and SSSCs computed by 2D and 3D ray-tracing. 2) 3D hybrid models consisting of global and regional models will be constructed and ray-tracing will be performed. 3D hybrid models will make use of the best available models for each region. Team members as part of related work may perform revision of 3D models using available data in selected regions. 3) Event clusters will be selected and used to define empirical travel time corrections for small selected regions. Inter-comparison of methodologies will contribute to a priori modeling error estimates. Offline unit testing and validation of model-based SSSCs will be performed using existing and expanded Ground Truth (GT).

Progress in Current Reporting Period

(September 14, 2002 – December 6, 2002)

<u>Administrative</u>

- A no-cost period of performance extension was requested of DTRA in early December 2002.

- The paper, entitled "Epicenter accuracy based on seismic network criteria" by Bondar, I., S.C. Myers, E.R. Engdahl and E.A. Bergman was cleared by DTRA for public release.

<u>Meetings/papers/memos</u>

- The paper for the 2002 SRS mtg was presented and is posted at the Consortium web site.

  McLaughlin, K., I. Bondár, X. Yang, J. Bhattacharyya, H. Israelsson, R. North, V. Kirichenko, E.R. Engdahl, M. Ritzwoller, A. Levshin, N. Shapiro, M. Antolik, A. Dziewonski, G. Ekström, H. Ghalib, I. Gupta, R. Wagner, W. Chan, W. Rivers, A. Hofstetter, A. Shapira, and G. Laske, Seismic Location Calibration in the Mediterranean, North Africa, Middle East and Western Eurasia, *24th Seismic Research Review*, Ponte Vedra Beach, FL, September 17-19, 2002.

- The following paper was presented at the 2002 Fall AGU meeting.

  Tkalcic, H. and Laske, G.: An Evaluation of Regionalized Models for Eurasia, 2002. *EOS Trans. AGU,* 83, F982.

- The following was published in the Geophysical Journal International.

  N. Cotte and G. Laske, Testing group velocity maps for Eurasia, *Geophysical Journal International*, 150, 639-650, 2002.

- The following paper has been accepted for publication:

  Antolik, M., Y.J. Gu, G. Ekström and A. Dziewonski, J362D28: A new joint model of compressional and shear velocities in the Earth's mantle, submitted to *Geophysical Journal International*, 2002.

<u>Model/SSSC development</u>:

During this reporting period the consortium continued to focus on Phase 2 model and SSSC testing and validation. During Phase 2, CUB will provide a revised 3D crust & upper mantle model (CUB2.0), CUB will continue to collect reference event data and validate GTX events with HDC cluster analysis, Harvard & SAIC will pursue the use of teleseismic P-wave SSSCs in the Group 2 region, GII continues to collect reference event data and investigate regional Pg and Lg in the Middle East, UCSD is evaluating crustal models for the region, Western Services will collect reference event data in central Asia, SAIC will continue to coordinate activities, maintain the reference event database, investigate model errors, and integration results. Some highlights of the reporting period are listed below.

- Regional SSSCs for phases Pg, Pn, Lg and Sn have been computed for a set of 1647 stations using the CUB2.0 model.

- Teleseismic (P phase) SSSCs for 2983 stations, globally distributed, have been computed for location validation testing. These SSSCs have been computed for the J362D28 model delivered by the Harvard group.

- Preliminary relocations tests have been carried out using the regional SSSCs.

- CU, Boulder has continued their regional model validation using cluster based empirical path corrections.

- We have performed relocation tests, using a technique similar to bootstrapping, to validate the regional and teleseismic SSSCs.

- GII continued analyzing waveforms from non-reporting IMS or IMS surrogates in North Africa and Middle East in search of picks for existing reference events.

- The UCSD group is continuing the comparison of regionalized models covering Western Eurasia and Northern Africa and has been comparing surface wave predictions with published maps (in particular the maps produced by groups at Harvard and Oxford University for phase and group velocity). The comparison includes predictions of Rayleigh and Love group and phase velocities at periods between 35 and 150s. To calculate the dispersion values, they started out by using the 1-D profiles for the 61 regions given in the SAIC model. For each region, they picked the dispersion values in the maps and binned them in histograms and also calculated the frequency-dependent equal area mean values of dispersion and compared these values with the SAIC 1.0 predictions. They found significant disagreement for some periods but not others in many of the regions. This indicates that certain parts in the chosen 1D-depth profiles in the SAIC1.0 model are consistent with surface wave data and acceptable but others are not and need adjustment. UCSD has also included an estimation of errors to indicate that discrepancies are significant and the comparison and recommendations are justified.

Plans for Next Reporting Period
(December 7, 2002 – February 28, 2003)

Administrative

- Finalize the no-cost period of performance extension through June 2003.

- Extend no-cost period of performance extensions for sub-contracts as required.

Papers/reports/memos

- Several papers documenting the results from Phase2 of this project will be drafted for publication and submitted to DTRA for public release.

Data development

- Emphasis will be placed on consolidating the Reference Event List 2.1 for relocation testing and validation in the next reporting period.

- Carry out outlier analysis to improve the validation dataset.

- GII will continue to read arrivals times for selected reference events at selected stations to augment the validation database.

Model development

- Model development is largely complete and only limited model development is underway. CUB will investigate improved methodologies for combining the CUB2.0 and J362D28 models. CUB will consider if a slightly revised version of CUB2.0 is warranted to improve possible regional baseline differences between the CUB2.0 Pn travel-times and teleseismic P-wave travel times.

SSSC validation

- The UCSD group will complete their model comparison in the next period. In particular, they plan to include the predicted surface wave dispersion of the CUB1.0 model that was developed in the Phase1 of the Consortium project.

- Validation testing of the CUB2.0 and J362D28 models will be carried out using empirical path corrections obtained from cluster analysis.

- Relocation tests will be performed to validate both regional and teleseismic SSSCs.

Cost Report

See attachment.